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SYSTEMS OF PLANTING
FOR ORCHARDS

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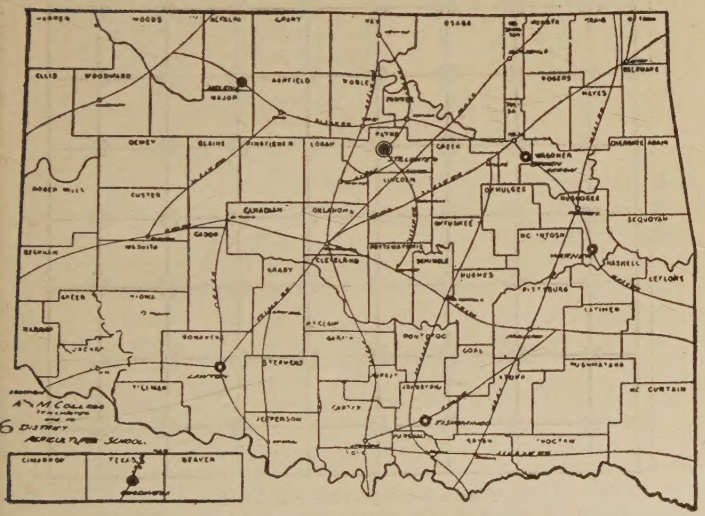

LOCATION OF THE A. & M. COLLEGE AND THE SIX SCHOOLS OF AGRICULTURE

STILLWATER, OKLAHOMA

SYSTEMS OF PLANTING FOR ORCHARDS

BY N. O. BOOTH
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There are three general plans of arrangement for planting trees in an orchard. These plans or systems are: The square system, the hexagonal or triangular system, and the quincunx system. The square system is where the trees are planted in squares; in the hexagonal system the trees are planted in equilateral triangles or hexagons, and in the quincunx system the trees are planted in squares with an extra tree in the center of the square. These systems are diagramed below.

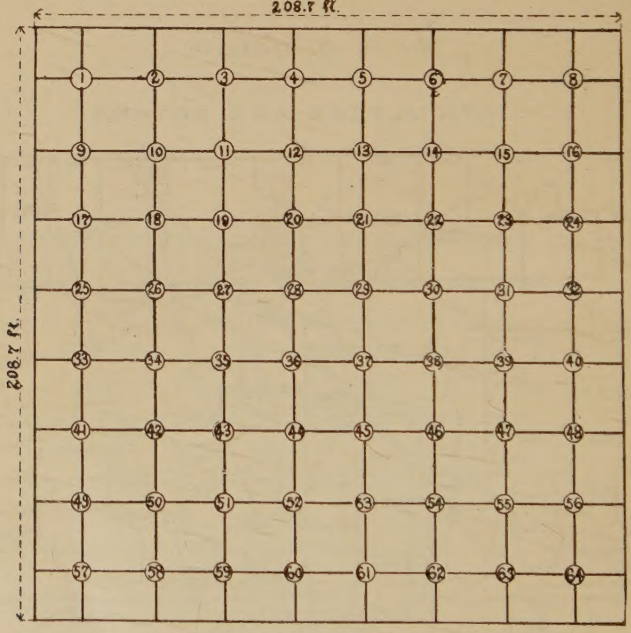

Figure 1.—SQUARE SYSTEM

The above plat represents an acre of land with the trees twenty-five feet apart.

The square system is the one most commonly used, but for years many writers on horticultural subjects have advocated one of the other two systems as being more economical with the ground; that is more trees could be planted on the same area and yet have the indi-

idual trees the same distance apart. The truth of this statement is ne that admits of some explaining.

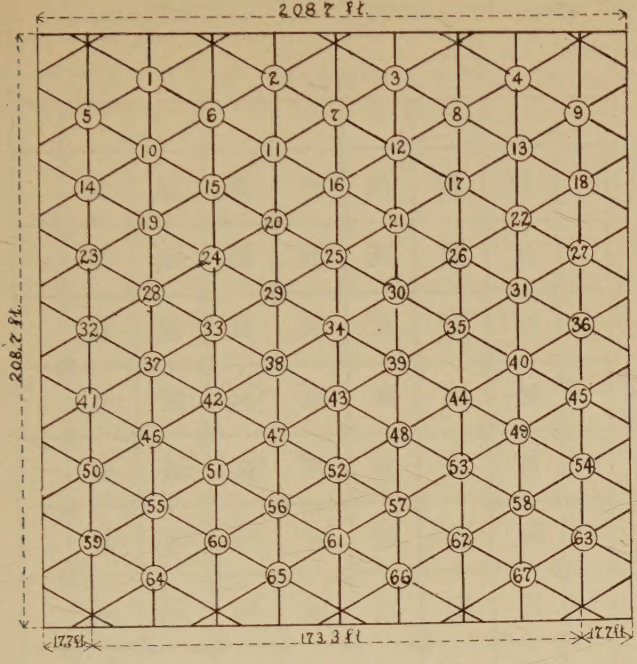

Figure 2.—HEXAGONAL OR TRIANGULAR SYSTEM
One acre of land with the trees twenty-five feet apart.

From the standpoint of the number of trees contained on an acre we find: That planted by the square system, with trees 25 feet apart, an acre will contain sixty-four trees. This leaves, however, about sixteen and three-fourths feet around the sides between the last row of trees and the outside line, instead of twelve and one-half feet, as would be intended. When the acre is planted by the triangular or hexagonal system it will be found to contain sixty-seven trees. Here again, however, in planting the single acre, the trees do not fit the plat, and there is a margin left over on two of the sides of sixteen and eight-tenths feet, instead of twelve and one-half. It is difficult to say how many trees may be planted on an acre by the quincunx system on account of the difference of meaning as to what is meant. Usually in comparing this system with others they are compared with the trees the same distance apart in the rows. This is not a quite fair comparison, however, for when trees are planted by this system the nearest tree to any given tree is not the next tree down the row, but the next tree diagonally across. Taking it in the sense in which it is generally used, and an acre of land planted according to the quincunx system contains 113 trees. Here, as in the square system, a sixteen and three-fourths foot margin is left instead of the intended twelve and one-half.

Number of Trees Per Acre Planted Twenty-Five Feet Apart

Square system 64
Hexagonal or triangular system 67
Quincunx system (trees twenty-five feet apart in the row, but only about fourteen and one-half feet from any tree to its nearest neighbor) 113

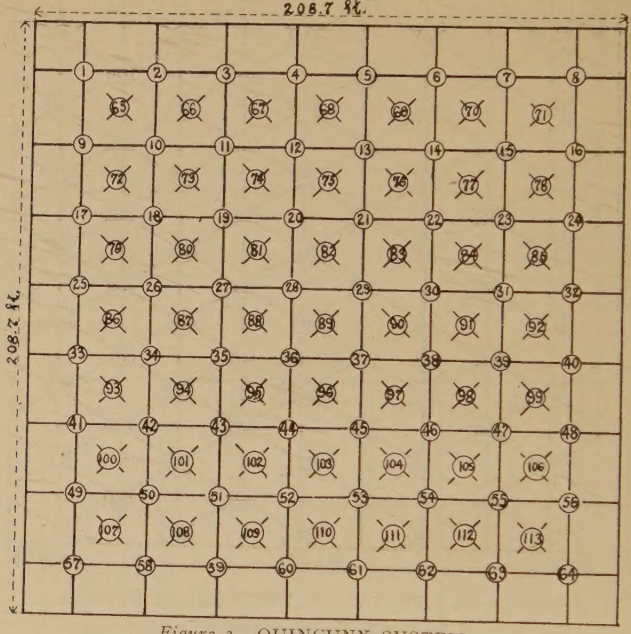

Figure 3.—QUINCUNX SYSTEM

One acre of land with the trees twenty-five feet apart in the row, but only about fourteen and one-half feet diagonally across, or from any tree to its nearest neighbor.

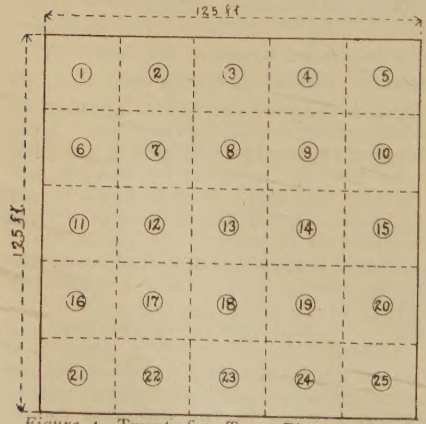

Figure 4—Twenty-five Trees Planted According to Square System—Dotted Lines indicate feeding area assigned to each tree.

Approaching the subject from another standpoint and we find that if we desire to plant twenty-five trees, twenty-five feet apart we have the following space required for the different methods of arranging: By the square system it will require a plat of land 125 feet square, with an area of 15,625 square feet. By the triangular system it will require a plat of land 137½ feet one way, by 111 62-100 the other, with an area of 15,345 square feet. By the quincunx system, as the meaning is usually accepted, that is with the trees twenty-five feet apart in the rows, the twenty-five trees occupy a tract of land 100 feet

iare with an area of 10,000 square feet. By the quincunx system in the ore correct sense of having the trees with twenty-five feet from any e to its nearest neighbor, twenty-five trees require a tract 131 feet h way, with a total area of 17,161 square feet.

Length, Breadth and Total Area Required to Plant Twenty-Five Trees Twenty-Five Feet Apart, By Different Systems

	Length.	Breadth.	Total Area.
uare system	125 ft.	125 ft.	15,625 sq. ft.
agonal or triangular system	137.5 ft.	111.6 ft.	15,247.7 sq. ft.
incunx system (trees twenty-five feet apart in row)	100 ft.	100 ft.	10,000 sq. ft.
incunx system (trees twenty-five feet apart in diagonal row)	131 ft.	131 ft.	17,161 sq. ft.

It will thus be seen that ere is a certain gain in the nount of land required to ant twenty-five trees, by ing the triangular rather an the square system of anting. This gain is evi- nt for even so small a act of land as that re- ired for twenty-five trees; d since it is evident that ere is a slight loss by the angular system on the tside rows, the gain ould be greater, propor- nately, with a larger area.

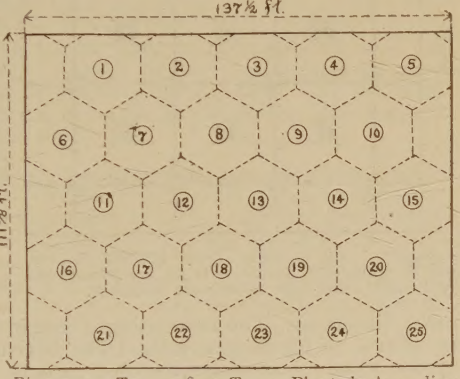

Figure 5.—Twenty-five Trees Planted According to Hexagonal System.—Dotted lines indicate feeding area of each tree.

It appears to be doubt- l if there is any gain in ing the quincunx system ther than the square system. In the small plat of twenty-five ees there is no gain but a decisive loss, when the trees are anted the same distance apart. There is, however, an evident and eat gain when an extra tree is added to the center of each square. o any person with the most rudimentary notion of geometry it is ident that there is no essential difference between the quincunx system and the square system. In the first case the rows run diagonally with the outside boundary, while in the second, they run at right angles, or parallel with the outside boundary. In both cases the trees are arranged in squares. Any one with an orchard planted on the square system can change it to the quincunx system by cutting off the corners until the outside boundary again becomes a rectangle with lines diagonal with the original boundary lines. It is thus evident that any gain in the number of trees put on a given area, by the quincunx rather than the square system, must be

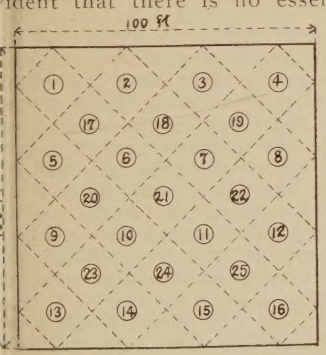

Figure 6.—Twenty-five Trees Plant- d According to Quincunx System.

made either by closer fitting in the margin of the field, or else by put ting the trees closer together. An examination of Cut No. 6, wher an equal feeding area is assigned to each tree, shows that there is a absolute loss on the margin. In other words, the whole space is no so equally divided among the different trees by the quincunx system a by the square system. An examination of Cut No. 5 shows that th same thing is true of the hexagonal or triangular system.

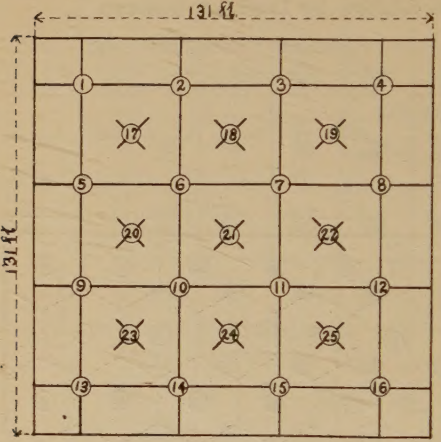

Figure 7.—Twenty-five Trees Planted According to Quincunx System.—Trees are twenty-five feet apart from tree in nearest neighbor.

The whole advantage c the use of either of thes systems over the older squar system is apparently base on the supposition that ther is some loss of space throug the fact that the room appor tioned to each individual tre is not a circle. Advocates c either of these systems spea of the distance between tree as though this factor alon controlled growth. This ap pears to be a mistake. Wheth er it be above ground or be low, all sorts of orchar trees seem to show a certai power to adapt themselves t the shape of the space t which they are assigned. Tw trees, growing alongside o one another, when th branches begin to interfere will make their growth i other directions. The same thing is true in the case of roots. This seem to be true of plants generally. The florist does not find that the plan in the square box stops its root growth as soon as the roots reac the side of the box. On the contrary, it continues to grow until th corners are completely filled with the roots, and only begins to fai when all the soil is exhausted. The action of tree roots is not so wel known because we do not so often have occasion to dig up matur trees, but what evidence we have seems to show that the roots of tree act similarly. We have all noticed trees growing alongside of pave ments in cities, where the pavement is of such a depth that there i no probability of there being any roots on that side, and yet many o these trees are quite vigorous. Many orchardists who plant thei trees with the rows twice as far apart one way as the other find tha the trees grow apparently quite as well as those in which the sam amount of space is assigned in a square rather than an oblon shape. If the above reasoning is correct, it seems as though ther can be no possible benefit to the tree from having the orchard ar ranged on the triangular system, where the feeding space is a hexa gon rather than on the square system, where the feeding space is square. In the estimation of the writer, the whole problem has bee considered from a wrong standpoint. So far as the welfare of th individual tree is concerned, there is only one thing to be considere that is the amount of feeding space assigned to each tree. When tree are planted twenty-five feet apart each way—that means that th leaves above ground and the roots below ground are given a spac twenty-five feet square as feeding room. If this space, either abov ground or below, is too small the trees are going to suffer, not be cause of the shape of the feeding area, but because of its lack of size

other words, when sixty-four trees are planted on an acre of land e planter is, to all intents and purposes, assigning one-sixty-fourth an acre to each tree, and there is no possible system of planting at will make it more than one-sixty-fourth of an acre.

There are, however, other things to be considered besides tree elfare. One of these, and one that is often advanced as a reason for anting trees in the quincunx style, is the adaptability of using the stem with so-called "fillers". In the Middle West there has grown a practice, which has been known for years, and which has found nsiderable favor, of planting two sorts of trees in the same orchard, ternating the one variety with the other. The object is to have the es about twice as thick on the ground as mature trees can be made thrive in that particular neighborhood, with the intention of cutting t a part of them when the trees begin to crowd. For this purpose e quincunx system is particularly well fitted, because it allows the mporary trees to be placed in the center of the square, and they ay be left considerably longer than would be the case if they were anted between the trees in the rows. There is no apparent reason hy the quincunx system may not be used to advantage for this pur-ose. Its advisability depends wholly on the advisability of using llers, a question on which fruit growers are divided. The triangular stem has no particular adaptation to the use of fillers, although it is metimes utilized for this purpose.

Besides the two considerations mentioned above, there is also the uestion of ease of cultivation. While there might be some difference opinion, I belive growers generally consider the orchards planted the square system the easiest tended. During the first few years, hile the trees are small, there is usually but little difference; although ren at this time the square system is slightly easier because the rows e farther apart. As the trees become larger, with both the quincunx nd triangular systems, it is usually necessary to cultivate the orchards agonally. Orchards cannot be cultivated diagonally as easily as ey can in the regular manner. In beginning at the corners, the con-ant turning, which the first few rows require, is very wearisome and erve racking to a team. There is certainly more turning done in ltivating this way than in the regular way, and those who are well le to judge say that it requires as much effort on the part of a team turn a plow or cultivator around as to go 200 feet straight ahead. his is wholly, of course, a matter of personal judgment. Such things n not be weighed exactly, but there is no question but that turning ould be avoided in cultivating, if possible.

To sum up the advantages of these different methods, it may be id that the square system is apparently best in all cases where a ermanent orchard is to be planted. The hexagonal or triangular stem does succeed in placing more trees on the ground, with the me distance between trees, but this is a very doubtful advantage. he quincunx system is not as economical of land as the square sys-m, and has no counterbalancing advantages, unless it be its adapta-ility to the filler system of planting. In ninety-nine cases out of a undred, the orchard planter will make no mistake in using the square stem. The term square here is meant to include all cases where e trees are planted in a rectangle. That is, there is no apparent bjection to the trees being put farther apart one way than the other.

The result of this reasoning is corroborated by the history of ese two methods of planting orchards in America. Both the qui-nx and triangular systems have been known and have had numer-

ous advocates in this country for over fifty years. A diagram ex
plaining the methods of planting, with a text extolling their advan
tages, was published as far back as the middle of the last century
From that time to the present day there has been a more or less in
termittent supply of articles in our horticultural press, the most o
which are favorable to one or the other of these methods of planting
Whether the cult is peculiar to America I am not able to say, but
have found no mention of it in any European publication. In spite o
its age in this country, it has never become popular. Most of th
orchards are still planted with the trees arranged in rectangles. A
orchard planted by either of hexagonal or quincunx plan is usuall
an indication that the planter is a beginner in fruit growing. Eve
in neighborhoods where an occasional old orchard is planted by on
or the other of these two systems, the newly planted orchards are practi
cally always planted the other way. The actual advantages of eithe
of these two systems, as revealed by practice, are evidently not s
great as to insure repetition on the part of the planter or imitatio
on the part of his neighbors.

Although neither one of these methods of arranging trees ha
become popular, it has been difficult for one to tell the reasons. A
expression of opinion of their merits has usually been an indicatio
of individual prejudice rather than anything carefully reasoned out
It is on this account that this paper has been written, giving mor
attention to certain unique arrangements of trees than their actua
occurrence in orchards would justify.